ASSESSMENT OF NATIONAL TECHNOLOGY POLICY IN FIJI*

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SCIENCE AND TECHNOLOGY POLICY IN FIJI

In Fiji, science and technology policy (STP) 1 has not hitherto been seen as a clearly distinct arm of overall policy, but rather as a heterogeneous set of inputs into other policy areas. Thus, no coherent statements exist as to the nature, limits and priorities of Fiji's science and technology policies. As a result, in order to ascertain which aspects of STP are to be considered of particular importance, and hence, especially worth investigating, and how the impact of such policy is to be evaluated, it is necessary to provide some background information on the overall objectives of development policy in Fiji. In this report, the main elements of development policy are summarized and the implications for STP examined. Attention is then drawn to the existence of conflicts between certain of the broad aims of development policy, and, as a consequence, between the contingent aims of STP--though the ambiguities so generated are shown to be more easily handled when a sectoral rather than a national approach is adopted.

BACKGROUND TO STP IN FIJI

The most general statement of the context in which Fiji's STP is set is contained in the *Development Plan*[2] (henceforth referred to as the *Plan*). STP seems likely to be particularly relevant to four of the expressed aims:

1. Strenghtening and diversification of the economic base
2. More equitable distribution of the benefits of development
3. Provision of employment for those seeking it
4. Promotion of self-reliance

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The body of the *Plan* is, in fact, an elaboration of approaches to achieving these goals, beginning with general strategies and then narrowing the focus to specific programs and activities. The strategies can be summarized as follows:

1. Strengthening and diversifying the economic base: To be achieved by promoting economic growth and at the same time "transforming" - that is, diversifying - the production base (at present heavily dependent on sugar and tourism) by increasing exports, encouraging viable import-substitution, developing cross-industry "linkages," attracting foreign investment and expanding production for the local market--particularly of resource-based goods. Further, no one act of investment should be excessively skill-intensive.

2. A more equitable distribution of the benefits of development: To be achieved by reducing the unevenness of income-distribution through increasing the attention paid to providing for the "basic needs" of the poorest members of the society; encouraging economic activity to move into deprived underdeveloped regions and areas where there is a potential for growth (the setting up of rural growth centres is important here); guarding against the emergence of undesired monopolies; and bearing in mind the need to promote equity between present and future generations when dealing with exploitation of non-renewable natural resources, social change, environmental matters, etc.

3. Provision of employment opportunities and the reduction of unemployment/ underemployment: Obviously tied into the overall growth process, though here it is felt that the impact of growth of employment may be seriously impaired if rising consumption is diverted mainly into the import market rather than being supplied by locally-produced goods; mechanisation has the effect of displacing labour; growth spurs rural-to-urban migration. Employment policy is therefore designed to curb any such tendencies.

4. Increased self-reliance: To be achieved by, *inter alia*, discouraging non-essential imports, encouraging local participation in investment and R&D activity, increasing the local stake in industrial investment, economizing on skilled labour use and discouraging undue reliance on government hand-outs.

General Implications for Technology Policy

Insofar as STP can effect the variables enumerated above, it will be expected to promote the following:

1. Continued vigorous growth of GNP

2. Diversification away from the present industrial base through increased exports and import substitution--especially through the increased use of local resources

3. Expansion of inward foreign investment, together with promotion of local participation and discouraging of monopoly

4. Job creation--in part by discouraging excessive importing, excessive mechanisation and rural-to-urban population drift

5. Provision for basic needs--partly through direction of economic activity towards deprived regions

6. Greater equity generally--between groups currently existing in the community and between present and future generations

7. Self-reliance to be promoted by discouraging non-essential imports, encouraging local participation in investment and production, encouraging local R&D effort and economy in use of scarce skills

Given the diversity of these aims, it is most unlikely that any one set of technology policy guidelines will be optimal, or "appropriate," from all points of view. Indeed, it is very likely that the effects of policies proposed for certain purposes will run directly counter to the interests of others--a common experience in all interdependent economies in which the effects of policies are multi-dimensional, and trade-offs are inevitable.

Obvious examples of such mutually contradictory aims are:

1. Conflict which may arise between employment and growth objectives in cases (i.e. industries) in which relatively labour-intensive technologies are very inefficient--in the sense of having very low productivity and/or product quality--while more capital-intensive technologies do not suffer from these disabilities

2. Conflict between the same two aims in cases in which much-needed inward foreign investment is more capital-intensive than seems desirable

3. Conflict between growth (and efficiency) and provision for basic needs

4. Possible conflict between efficient allocation of resources and the opening up of remote, backward and inherently unproductive regions

5. Conflict between growth and inter-temporal equity in situations in which rapid exploitation of non-renewable resources is possible

6. Conflict between the import-orientated drift of demand resulting from rising personal incomes as growth proceeds, and the desire to grow, in part by import substitution

7. More generally, the conflict between the needs of the different sectors in a "dual" society, in which the requirements of the "traditional, communal-social mode of development" are likely to run counter to the more individualistic demands of modern economic growth

A tabular presentation of the extent of compatibility/contradiction in respect of the broad aims of technology policy is set out in *Table 1*. The content of the table is indicative, rather than definitive, as it is not possible to assess adequately the compatibility or otherwise of policies without a full analysis of the precise nature and content of these policies. The table reflects past experience in other developing countries rather than the specific case of Fiji. Moreover, it refers to the short and medium-term situation rather than the long-term--so that the hypothesized interactions between policies are those which might be expected to operate within one plan period. (This last point is particularly important with regard to the long-run relationships between growth and employment, between diversification and employment, and between basic needs provision and employment.)

Table 1: COMPATIBILITY AND CONTRADICTION IN THE BROAD AIMS OF TECHNOLOGY POLICY

	Growth of GDP	Diversification of industrial base	More even distribution of income	Provision for "basic" needs	Assistance to backward regions	Encouragement of inward foreign investment	Job creation	More self-reliance
Growth of GDP	--							
Diversification of industrial base	M	--						
More even distribution of income	M	C	--					
Provision for "basic" needs	I	C	C	--				
Assistance to backward regions	I	C	C	C	--			
Encouragement of inward foreign investment	C	C	M	P	I	--		
Job creation	M	C	C	C	C	C	--	
More self-reliance	C	C	C	C	C	I	C	--

KEY:
- C Compatible
- I Incompatible
- M May be compatible or incompatible - depending on circumstances
- P Probably irrelevant

It is often helpful to policy-makers if policy analysis includes some indication of the "appropriateness" of different policies in terms of a particular interpretation of development aims, i.e. assuming a particular set of weights attached to the various effects of policy, if only as a starting point for discussion. In this context, one important division of the economy along "policy impact" lines is that into "modern sector" industry, for which it is assumed that the *Plan* aims of growth, diversification and increased self-reliance (via exporting and import-substitution) take precedence in the event of a conflict over employment, equity and provision for basic needs; and "traditional" or small-scale industry, in which policy amounts to a "holding operation" rather than to a basis for sound, organic, long-run growth, and for which it is assumed that the *Plan* aims of job creation, more even distribution of income, and emphasis on provision for basic needs are paramount considerations.

Clearly such a distinction may have a significant impact on the assessment of STP. For example, looking at the assessments of the effects of STP set out in *Table 2*, it will be seen that whereas high capital-intensity coupled with low employment-generating power may be regarded as a disability in an industry in a disadvantaged rural area (so that an STP which favoured selection of such technologies would be marked down on this count), it may in fact be crucial to the success of a sophisticated industry processing local inputs for export, e.g. the Fiji sugar industry. Hence STP which facilitates purchase and use of such machinery would in this case probably be judged as appropriate overall. Again it will also be seen from *Table 2* that while in both sectors there is agreement as to the desirability of policies which ease transfer of technology, which cut pollution or which accelerate the diffusion of technical and managerial knowhow, important differences in emphasis exist with respect to capital-intensity, the demand for scarce skills, the impact on income distribution, the extent of provision for basic needs, the job-creating capacity, the impact on rural-urban migration and the nationality of ownership. Clearly it is desirable in terms of short-term strategy that new investment should be labour-intensive and job-creating, should not impose undue demands on the supply of scarce skills, should have a progressive effect on income distribution, should alleviate the pressure of migration on urban areas, should contribute to providing an acceptable standard of living for the poor, and should be locally oriented. But here long-run and short-run aims may well be in conflict. Fewer jobs now may mean more later. A mildly regressive impact on income distribution may stimulate secondary development which has countervailing progressive effects later. In short, it is perfectly possible that projects which in the short run do not seem optimal in terms of their effects on social and economic indicators may have favourable long-run consequences. Thus the criteria to be used in assessing activities involving science and technology must allow for trade-offs and general equilibrium effects and should include some indication of the time horizon over which assessment is to be carried out.

Table 2: PROFILE OF STP ASSESSMENT IN TERMS OF KEY CRITERIA

Criterion	Predicted impact of STP	Assessment "Modern" sector						Traditional/informal/rural/small-scale sector					
		Highly desirable	Acceptable	Undesirable	Highly undesirable	Indeterminate	Irrelevant	Highly desirable	Acceptable	Undesirable	Highly undesirable	Indeterminate	Irrelevant
Capital-intensity	Increase		X*	X*							X		
	Reduce		X					X					
Demand for scarce skills	Increase		X*	X						X*	X		
	Reduce	X	X					X					
Impact on income distribution	Regressive		X*		X						X		
	Progressive	X						X					
Urban-rural migration	Increase		X*		X						X		
	Reduce	X						X					
"Basic needs" provision	Ignores		X*	X							X		
	Provides for	X						X					
Linkages (backward and forward)	Weakens				X						X		
	Strengthens	X						X					
Nationality of ownership	Foreign		X							X			
	local	X						X					
Job creation	Negative/neutral		X*	X							X		
	Positive	X						X					
Local R&D	Represses			X						X			
	Stimulates	X						X					
Transfer of foreign technology	Makes more difficult			X					X			X	X*
	Facilitates	X						X					

*Certain industries only: i.e. this "assessment" does not rule out such an outcome as unacceptable.

In what follows, any reference to "appropriateness" unless otherwise qualified should be interpreted as referring to the configuration of criteria set out in *Table 2*.

Although it is frequently asserted of LDCs that "they have no technology policy," this is, in fact, very rarely true. The earlier discussion implies that it is almost certain that all countries operate some kind of technology policy, though it may be in part "implicit" (and hence not perceived for what it is) and, in so far as it is "explicit" may exist in the form of a number of unconnected directional objectives never tied together under one policy heading.

Fiji is a case in point. Though it has been claimed that the country has no technology policy[3] and no official reference to such a policy exists beyond four brief paragraphs in the *Plan*,[4] an analysis of it and other official sources discloses the existence of a considerable volume and variety of "explicit" and "implicit" policies.

"EXPLICIT" POLICIES AND INSTRUMENTS

The purpose of this section is to discuss the relevant strategies and policies embedded in the *Plan*, to classify them, and to estimate the resource requirements of the "explicit" policies.

The function of policy listings is to illustrate the wide-ranging and often incoherent character of the current "technology policy" and to indicate the nature of raw material the technology policy analyst works with. It should be noted, however, that the items listed do not exhaust the roster of relevant policies, but merely those the existence of which is apparent from key official publications. In practice it is found that investigation of many policies or industries turns up a variety of subsidiary *ad hoc* ("low level") policies which may be of importance in determining the character of technology policy as a whole.

The central statements on STP for purposes of the present study are to be found in the *Plan* and the UNCSTD paper on Fiji. The most direct reference is the declaration that, "it has become increasingly recognized in recent years that the choice of technology in industry, agriculture, transport and construction has very significant implications for the degree of success in the implementation of Government objectives" (*Plan.*) The specific nature of these "implications" is reflected in the explicit policies and instruments proposed and listed in *Table 3*.

The policies listed in the table are self-explanatory as are the instruments though it will be noted that the degree of specificity of the latter varies. In some cases (e.g. increased spending on technical education), the aim and means of accomplishing it are fairly clear as the legal devices, organizational structures and operational mechanisms are already in place in the form of the existing educational system. In others (e.g. "encouragement of an improved capacity for applying technology"), it is not clear to what extent an enforcing mechanism exists as the mode of implementation is left vague. In still others an

intermedicate situation prevails. (As noted earlier, this list is not exhaustive as it includes only explicit policies covered in major official publications.)

"IMPLICT" SCIENCE AND TECHNOLOGY POLICIES AND INSTRUMENTS

It will be recalled that implicit STP influences scientific and technological functions as a "side-effect" (though once this is recognized the instrument may be used "explicitly" thereafter) remote from its prime purpose. In this section are listed those aspects of Fiji's government policy which seem likely to influence scientific and technological variables in this way. It should be noted that this listing--set out in *Table 4*--is drawn from major official published sources, and does not include various implicit policies disclosed by the field investigations. It is thus intended as an illustration of the general nature of implicit STP, and as a register of those implicit policies embodied in major public documents.

Table 3: "EXPLICIT" POLICIES AND INSTRUMENTS

POLICY	INSTRUMENT
A. Encourages the choice of (usually imported) technologies which are "appropriate in the sense that they are not excessively capital-intensive and create employment, while not impairing profitability or causing prices to consumers to rise because of reduced efficiency, excessively high cost and tying of users to high-cost imported intermediate inputs. This applies to industry, construction and agriculture--though specific provisions also apply to the last three of these (discussed below). In all cases, the technology should be "consistent in its impact with the general aims of the development strategy set out in the *Plan* ".	1. A "clearly thought-out" package of policies on import duties for machinery, incentives, tax holidays and depreciation allowances designed to encourage the purchasing of technologies with "appropriate" characteristics. Provision of industrial estates. 2. Improved technology identification and selection procedures to be installed in the government service, along with a strengthened capacity for project preparation, evaluation and monitoring. 3. Encouragement of an improved capacity for applying technology. 4. Provision of loans for technical services. 5. Reinforcement of the capacity of private engineering consultancy firms.

Table 3: (Cont'd)

	6. Development and provision of use of labor-intensive methods where possible--especially in the small-scale, rural and cottage industries.
	7. Setting up of an industrial information and extension service (which will, *inter alia*, assist private firms in choosing technology).
B. In transportation--promote more labour-intensive methods.	Limits on engine size; selective duties on marine engines; encouragement of efficient mass transport.
C. In construction--promote more labour-intensive methods.	Encouragement of "careful attention to management and tools used".
D. In agriculture--encourage the use of technologies for land preparation, weeding and harvesting which raise productivity, minimize back-breaking labour, and do not involve the importing of costly foreign machines designed for large-scale operation.	1. Setting up of a rural technology unit (within the government) to develop new technologies. 2. Strengthen local R&D capacity in this area. 3. Strengthen extension services for disseminating information on "appropriate" technologies.
E. Ensure that technologies received as "aid in kind" conform to the general technology priorities noted in A to D above.	Application of the relevant STPI listed above in assessing technology to be imported.
F. Encourage and develop interregional cooperation in S&T (especially the sharing of R&D results, improving information flows and production of international transfer of technology).	Technical cooperation agreements.

The policies themselves cover a wide range of activities and are here identified as STP/STPI for a variety of reasons. Thus, in some cases, the "implicit" STPI may be expected to have the effect of altering relative factor costs or availability[5], or they call for an enhanced availability of labour force skills (and hence also a greater demand for training resources in these areas);[6] or they may encourage inward private foreign investment, which

may be expected to affect the technology profile of the economy as well as the pattern of demand for scientific and technical skills;[7] or they relate to government procurement procedures;[8] standards legislation;[9] or pollution control--all of which may have implications for the kinds of technologies used and the technical skills associated with these technologies. Finally, a considerable number of cases listed in *Table 4* fall into a borderline category, such that the instrument itself (the STPI) is clearly designed to affect technology directly, while the policy (the STP) has some other aim; that is, the science and technology aspect is "implicit" in terms of the policies but "explicit" in terms of the instruments designed to implement the policies. Such examples impair the neatness of the classification system, but pose no special analytical problems.

Table 4: "IMPLICIT" POLICIES AND INSTRUMENTS

Policy	Instrument
<u>Influencing relative factor costs:</u>	
A. Improvement in wages and incomes in line with productivity increases	Tripartite Forum and Wages Councils.
B. Improved working conditions for labour force (with special reference to standards of "health, safety, comfort and convenience")	New labour laws and regulations.
C. Control over interest rates and credit	1. Central Monetary Authority's advice on rates to private banking system.[10]
	2. Lending policies of FDB, MAF and MFAR.
D. Provisions of pensions for employees	FNPF levy of 7% of gross wage bill of participating employees.
E. Promotion of industrial training	Levy on all employers of 1% of gross payroll as Fiji National Training Council levy.
F. Control of inflation	Prices and incomes policy.
<u>Promoting selective expansion of industry</u>:	
A. "Priority" industries	1. Preferential incentives and concessions.

Table 4: (Cont'd)

	2. CMA advice to banks to favour "priority" industries.
B. Agriculture	Introduction of improved plant and animal stock.
C. Fisheries	1. Increased emphasis on training in fish methods, boat maintenance, fish-processing and marketing.
	2. Encouraging of fish-farming.
	3. Provision of technical advice by the Fisheries Division of MAF.
	4. Improved design of traditional equipment for rural fisheries.
	5. Identificaton of exploitable marine resources.
D. Forestry professionals	1. Improved training of
	2. Research into potential uses of Fiji timbers.
E. Primary production generally	"Vigorous government assistance to all categories of the private sector through infrastructure, credit and advice." More specifically, this will take the form of: (l) encouraging local consultancies; (2) assisting in project preparation; (3) giving legal advice; (4) advising on choice of technology; (5) advising on marketing; (6) helping with and advising on export promotion.
<u>Regional development</u>	Promotion of regional growth centres with preferential incentives for agro-processing industries.
<u>Rural development</u>	1. Improved technology - through training in technology selection and R&D on technological alternatives.
	2. Provision of loans.
<u>Upgrading of labour force skills</u>	Increased emphasis on technical education.

Table 4: (Cont'd)

Continued localizations of posts in the private and public sectors	Use of work permits. 2. Continued upgrading of skills of local labour. 3. Recruiting policy in public sector.
Expansion of inward private foreign investment--especially in "priority" industries	Fiscal and other incentives and concessions.
More efficient use of energy	1. Investigation of alternative energy sources. 2. R&D on new technologies for the more efficient use of energy.
Maintaining strength of currency (by	A range of policies - export promotion, import restriction tariff and non-tariff barriers) exchange controls.
Government procurement	Procurement procedures of NMA, FEA, Housing Authority, PWD, etc.
Standards legislation	Monitoring of product quality/ standard.
Pollution control	Pollution control legislation.

IMPLICATIONS FOR S&T INPUTS IN THE PUBLIC SECTOR

Precise S&T resource requirements are rarely mentioned in the *Plan*, but some relevant information is provided in the budget estimates for 1982 (which contain projections for 1983-84).

Since neither the *Plan* nor the budget identify S&T activities as such, it is not possible to isolate S&T resource needs cleanly from the remainder of the program. However, it is possible to identify a wide range of forms of S&T input in many of the projects listed in the *Plan*. For the most part, the S&T input involves the application of specific skills--in advising, training, conducting process or product research and/or development (including, in some cases, research on the "appropriateness" of technologies), carrying out research in

the spheres of economics, sociology and health, and executing project appraisals (including, in some cases, technology appraisals). Finally, S&T activities may take the form of direct provision of equipment or other material inputs.

S&T activities embodied in the *Plan* are classified in terms of their distribution by kind across the main economic sectors. It must be emphasized here that for present purposes the borderline between what is and what is not an S&T activity must inevitably be drawn in an arbitrary manner as it is often not clear from the *Plan* precisely what inputs are involved in particular activities. As a result, some S&T activities may have been omitted from the listing, while some of the activities included may, in fact, have only marginal relevance to science and technology.[11]

The classification is set out in *Table 5*, which refers to the entire *Plan* period, 1981-85. While, the table is inevitably incomplete and cannot give a precise impression of the relative significance of S&T inputs in the different sectors, it is clear that the number of activities is considerable (93 are listed) and the distribution across sectors uneven.

Table 5: THE PLAN FORM OF ACTIVITIES INVOLVING SCIENTIFIC AND/OR TECHNOLOGICAL INPUTS, BY SECTOR

	Agri.	Fish.	Forest.	Indust.	Energy	Transp.	Tourism	Total
Extension work	14	2	--	2	--	--	--	18
Training	9	8	1	1	--	--	1	20
Technical advice and research on technology	7	2	--	7	11	--	--	27
Other research	12	2	2	--	2	1	--	19
Project appraisal/ feasibility studies	3	3	--	--	--	--	--	6
Major use of consultants	2	1	--	--	--	--	--	3
Total	47	18	3	10	13	1	1	93

Industry, including agro-based industry, accounts for only 11 percent of S&T activities, while agriculture and fisheries account for well over half (65 percent), reflecting the relatively fragmented (spatially) and diverse nature of the latter sector. The energy sector, which covers the energy inputs of all other sectors, is to be the subject of an appreciable

amount of research and technical activity. Tourism is not yet seen as an area in which S&T activities have much to offer. Forestry and transport are also characterized by a small number of S&T activities proposed over the *Plan* period.

As regards the forms taken by projected S&T activities--research, technical advice and extension work account for nearly three-quarters of the total. Most of the wholly new S&T initiatives are to be found in advisory and research activities. Of particular interest here are (a) the provision of an industrial information service for cottage and small-scale/rural industries; (b) the setting up by MFARD of a unit to encourage the design, production and use of appropriate modes of transportation in rural area; (c) the design of new, appropriate and low-technology farm elements and (d) the investigation of small-scale technology for rice irrigation; (e) the development of appropriate, low-cost technology to increase crop production efficiencies and reduce production costs (especially in relation to labour-intensive crops).

While it is not possible to assess the resource implications of the S&T program as a whole in the absence of detailed information on costs, it is clear from the range and character of the S&T activities that the demand, put by the *Plan* on Fiji's science and technology resources is likely to be a heavy one.

No specific estimates are available on the cost of S&T activities over the *Plan* period. But, some rough estimates may be made on the basis of the 1982 budget.[12] The figures presented in *Table 6* were derived by aggregating figures for each 1981-84. They include activities related to training or the direct application of scientific and/or technological expertise and the administrative back-up facilities specific to such activities. Given the nature of the data, it is inevitable that some S&T activities have been overlooked and that some non-S&T expenditures have been included in the estimation process. For this reason, the figures in *Table 6* should be regarded as indicating orders of magnitude rather than precise measures of the importance of S&T activities, or the use of S&T resources in the public sector.

Table 6: **BUDGET ESTIMATES OF S&T EXPENDITURE, 1981-84**

	Estimated or planned S&T expenditure* ($000)					
	1981	1982	1983	1984	Total	% of S&T total
Agri & Fisheries	9248	13574	8911	8981	40714	40
Forestry	1006	1120	1064	1083	4273	4
Energy	251	201	207	659	1	
Fijian affairs	1357	1333	733	753	4176	4
Education	4148	4317	4090	4176	16731	16
Health	1574	1976	1988	1786	7324	7
Lands	2681	2601	2470	2245	9997	10
Commerce and Industry	275	169	53	---	497	1
Co-operatives	670	799	836	783	3088	3
USP	3279	3872	3872	3872	14895	15
Total S&T	24238	30012	24218	23886	102354	100
% of total budget	8	9	8	7	8	--
% of sector budget	20	22	20	19	20	--

* 1981 estimates; 1982 projections; 1983 and 1984 - projections. Aid in kind included. Source: 1982 Budget

This having been said, it still seems likely that the largest single block of S&T activity, as measured by cost, will be attributable to agriculture and fisheries (nearly 40 percent); much of this is attributable to extension activities. Education[13] comes next with just over 16 percent of the aggregate S&T budget, (just over 30 percent if Fiji's contribution to the University of the South Pacific is included).

Overall expenditure on S&T activities accounts for around 20 percent of the budgets of the ministries and departments in which it occurs, or around eight percent of the global budget. Making allowance for those cases where the allocation of budget outlays to S&T activities is particularly speculative, it seems fair to estimate expenditure on S&T activities broadly construed as accounting for between five percent and ten percent of the total budget over 1981-84.

Employment figures from 1982 are available for the expenditures referred to in *Table 6*. It will be seen from *Table 7* that, in all, around 2,154 persons are likely to be engaged in some form of S&T-related work in the public sector in 1982. Once again, problems of definition arise--the line between S&T and non-S&T activities being difficult to draw given the nature of the data--but the estimate is probably accurate to within 15 percent either way. Thus, as with the expenditure figures, it seems likely that the proportion of public sector manpower devoted to some form of S&T activity, broadly construed, lies in the range five percent to ten percent--equivalent to nearly three percent of all formal sector employment.

Table 7: EMPLOYMENT IN, OR ASSOCIATED WITH, BUDGETED S&T ACTIVITIES IN 1982*

	Projected Employment	% of total budgeted employment**
Agriculture and fisheries	843	3.2(%)
Forestry	443	1.7
Energy	15	0.1
Fijian affairs	92	0.4
Education	430	1.7
Health	224	0.9
Lands	279	1.1
Commerce and industry	27	0.1
Cooperatives	106	0.4
USP	N/A	N/A
Total	2,154	8.3

*Source: 1982 Budget.
** USP excluded.

CONCLUSIONS

This study has identified the main elements of science and technology policy in Fiji, and assessed the appropriateness, effectiveness and adequacy of them. Earlier sections covered a wide range of issues. In this final section the conclusions are summarized, and their policy implications are drawn together.

Although science and technology policy is not regarded as a distinct, coherent sector of development policy in Fiji, it would be quite wrong to conclude that no STP exists. The regular scientific and technological activities, or projected activities, of public sector agents as set out in the *Plan* and the *Budget*, alone absorb an appreciable proportion of the financial and manpower resources of government. In addition, a limited number of "explicit" science and technology policies, and a much wider range of "implicit" policies bear on scientific and technological variables, and hence, on development variables.

The main thrust of explicit STP in Fiji has been directed at the nature of the plant and machinery chosen by local producers. The intention has been to promote the use of "appropriate" technologies, which means non-capital intensive technologies. This applies to all sectors of the economy and refers to both demand (i.e., the nature of choices and sources of technology) and supply (i.e., the nature of the technology being designed and developed locally or embodied in foreign aid). Of course, this aim is not an end in itself,

but is related directly to the important development aims of creating more employment, diversifying the industrial base, spreading the benefits of economic growth by progressive redistribution of income and provision for "basic needs" in rural areas, economizing on scarce skills (in some industries), encouraging inward foreign investment and self-reliance.

It is clear that this central aim of explicit technology policy has not been achieved, and does not seem likely to be achieved as things stand. Fiji is a relatively capital intensive economy, by developing country standards (allowing for differences in levels of development and size). Much of the growth in employment and output in recent years has been in the more capital intensive sectors of the economy. Labour-intensive technologies in any sector of the economy in the recent past have not grown, nor have we seen a shift away from "inherently" capital intensive industries towards "inherently" labour-intensive ones. Furthermore, none of the sample of firms interviewed was aware of any effective attempts by government to influence their choice of technology in this particular direction.

Far from becoming less dependent on the outside world for its technology, Fiji remains almost totally dependent on foreign suppliers for both the design and supply of its capital equipment. There is no early prospect of a shift to local suppliers, nor even of a shift to developing country suppliers--who might be expected to produce plant and machinery somewhat more appropriate to Fiji's needs.

With regard to foreign aid, it again seems that the production equipment used in aid-financed projects is usually capital intensive. (Only in the important case of the sugar industry does explicit technology policy appear to have been successful in holding down capital intensity and preserving jobs--in this case by the simple expedient of imposing a *de facto* ban on imports of mechanical cane harvesters).

It is still necessary to consider the possibility that explicit STP has achieved some of the basic aims of policy and furthered broader development aims. However, a consideration of the summary of the dimensions of "technological mastery" suggests that this is not so. It is not apparent that Fiji's explicit STP in recent years has assisted in a significant way the achieving of *any* of the development-related goals of such policy--"the ability to identify and choose 'appropriate' technologies, to bargain successfully for imported technologies, to operate plant and machinery efficiently, to adapt and modify existing equipment over time, and perhaps to engage in a certain amount of original R&D with regard to products and/or processes".

It is true that certain isolated acts of technology policy, such as support for research in fisheries, have helped achieve these ends. But the central thrust of explicit policy, has had very little impact on technology. Hence any impact it may have had on key development variables--and this is not substantial--has not had effect through the technology targets at which it was aimed.

The results of various investigations carried out for this study indicate that failures of the "factor proportions" aspect of technology policy (in all but the sugar industry) are related to inadequacies of policy instruments and on the part of the administration to appreciate the significance of the impact of "implicit" policies on technology variables, and the possibility that they might conflict with explicit policy.

The most striking shortcomings in this respect are as follows:

1. No "clearly thought out" package of fiscal measures, tariffs and incentives designed to encourage a choice of technology with "appropriate" characteristics has yet been devised. Analysis of the fiscal system suggests the existence of a bias in favour of increased capital intensity (as well as increased demand for skilled labour, reduced capacity utilization, and increased dependence on other countries). The import tariff structure, when taken with restrictions on importing is not systematically related to any particular dimension of technology choice and transfer or to development policy as a whole. The battery of incentives available to local industry also seems to encourage enhanced capital intensity (as well as penalising high profitability and growth).

2. No evidence could be found of "improved technology identification and selection procedures (being) installed in the Government service," though it did seem to be the case that capacity for "project preparation, evaluation and monitoring" was under serious review.

3. Development and promotion of the use of labour intensive methods in agriculture, and in the small scale, rural, and cottage industries has not occurred, and the attempts to devise new "appropriate" technologies through the rural technology workshop have been abandoned.

4. No effective system exists for "disseminating information on 'appropriate' technologies".

5. The projected "industrial information service" has not yet been brought into being.

6. Far from being "strengthened," local R&D capacity in the area of labour-intensive technologies has actually atrophied in recent years. In effect, virtually no industrial R&D is now being carried out in Fiji.

7. No serious attempt is made to "assess imported technology"--neither that purchased by local firms nor that brought in by foreign-owned firms.

8. Technical cooperation agreements have had very little pay-off in terms of facilitating the introduction of "low technology."

9. The procedures used by Government in negotiating foreign-aid agreements pay very little attention to technology as such.

With regard to the potential efficiency of policy instruments, considerable variation is observed. In terms of the range of firms and S&T activites affected, some of the STPI referred to above, particularly the fiscal, tariff and incentive measures, "score" fairly high. Others, in particular technical cooperation agreements and strengthening of local R&D, score fairly low because of the uncertainty of pay-off, and the very considerable inputs of knowhow required to make them effective. Still others are attractive because of their very strong (anticipated) performance in certain respects. For instance, improving consultancy facilities and providing an expert industrial information service could have salutory effects on the industrial sector despite their considerable requirements for expertise.

Overall, the policy instruments chosen by government are not unsuited to their allotted tasks. The reasons for their failure lie with the nature of the execution of policy rather than with its general specification.

Given the interconnected nature of an economy such as that of Fiji, it is inevitable that many policies not aimed at particular variables will nevertheless affect them. These indirect effects of implicit technology policies are important to Fiji. Perhaps the most significant implicit policies are those connected with the fiscal, import tariff and incentive systems. These have already been discussed under the heading of "explicit" influences, since it is declared policy that they should be brought to bear on science and technology targets. In practice, however, only very perfunctory attempts have been made in the public service to analyze and predict their probable effects on science and technology.

The general favouring of increased capital intensity (with such associated characteristics as increased demand for skills and reduced pressure to utilize capacity) extends to other areas of implicit technology policy. Thus the policy of improving wages and incomes in line with productivity increases, of improving working conditions of labour, and of requiring employers to make FNPF and FNTC contributions, have the effect of increasing labour costs and encouraging labour-saving practices. The "cheap money" policies have the same effect, in that they facilitate substitution of capital for labour.

The overall conclusion based on the assessment of explicit technology policy is that a formidable catalogue of failures to implement policy, and failures to comprehend the full implications of certain policy instruments, have combined to frustrate the government's intention to manipulate science and technology choice. This having been said, it is necessary to note that the view that policy is a means of influencing the capital intensity and nothing else is a grossly over-simplified one. Changing the factor proportions incorporated in technology is likely to have multi-dimensional effects on other techno-economic variables relevant to the development process. Different sectors of the economy may have

different technology requirements, and a variety of technological issues lie outside the capital intensive versus labour intensive concern. Where possible and appropriate, the aim is to assess the extent to which existing policy is pushing in the right direction and is adequate to the task of achieving both STP and broader development aims.

NOTES:

1. Throughout this report the term "science and technology policy" is often used in preference to the more restricted formulation "technology policy," this usage reflecting the often clearly integrated nature of scientific and technological activities. Since the bias of such activity in Fiji is heavily weighted towards the technological side, the current project is referred to as a "technology policy assessment," but this should be construed as incorporating "science policy assessment" where this is relevant, or unavoidable, in the course of the analysis.

2. *Fiji's Eighth Development Plan, 1981-85*, Central Planning Office, Suva, 1980.

3. See e.g. D. Medford and H. Rothman, *The South Pacific Sub-Regional UNCSTD Paper*, University of the South Pacific, Suva, 1978.

4. *Fiji's Eighth Development Plan, 1981-1985, ibid.*

5. Items (a), (b)(i), (d)(3).

6. Items (b)(ii)(2) and (3); (b)(iii)(1) and (3); (b)(iv)(1); (b)(v); (e) and (f).

7. Item (c).

8. Item (1).

9. Items (b)(ii)(1); (b)(iii)(2), (4), (5); (b)(iv)(2); (d)(1); (h).

10. "Historically, rates in Fiji have been held at low levels as a means to encourage investment," in *DP8* (p. 69).

11. Furthermore, a number of minor project appraisal exercises have been excluded and a small number of activities involving S&T input could not be classified.

12. *The Fiji Budget Estimates, 1982*, provide expenditure estimates for 1981 and projections for 1982, 1983, and 1984. The figures for the last two years are provisional and may be subject to substantial revision as new items of expenditure emerge over time.

13. Education is here defined as tertiary and technical education.